FREQUENCY CANCELLOR DESIGN

SITI HASMAH BINTI JAMALI

Universiti Malaysia Sarawak
2000

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Tesis Dikemukakan Kepada
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(HURUF BESAR)

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Tarikh: 27 Mac 2000

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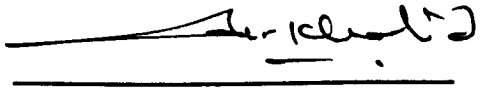
This project report attached hereto, entitled " Frequency Cancellor Design". Prepare and submitted by Siti Hasmah Jamali as a partial fulfillment of the requirement for the degree of Bachelor of Engineering with honours (Electronic and Telecommunication) is hereby read and approved by:



Al Khalid Othman

Supervisor

3/4/2008

Date

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ABSTRAK

Dalam litar elektronik kerap kali diperlukan pemisahan satu jalur frekuensi daripada jalur frekuensi yang lain. Tugas ini dilakukan oleh penuras "filter" yang membenarkan satu jalur frekuensi melaluinya dan memotong jalur frekuensi yang lain daripada melaluinya. Penggunaan alat penuras adalah penting seperti contoh dalam telekomunikasi iaitu mengurangkan kesan herotan dan juga berperanan dalam menghalang frekuensi yang tidak diperlukan. Dalam projek ini ia diaplikasikan pada penggunaan penerus gelombang penuh "full wave rectifier". Penerus ialah proses penukaran arus ulang-alik menjadi arus terus iaitu dengan menggunakan peranti"diode" yang membenarkan arus mengalir pada satu arah sahaja. Penerus digunakan dalam unit bekalan kuasa arus terus dan untuk beberapa tugas lain seperti penyahmodulat.

Penerusan gelombang penuh akan mengeluarkan kedua-dua separuh isyarat tetapi kedua-duanya sama arah. Masukan arus ulang-alik biasanya diambil dari bekalan kuasa utama yang akan melalui pengubah"transformer". Pada kebanyakan bekalan kuasa arus terus, pengubah digunakan sebelum penerus bagi menukarkan masukan arus ulang-alik ke aras voltan yang dikehendaki. Nisbah belitan pengubah menentukan aras arus terus yang dapat dikeluarkan oleh bekalan kuasa itu. Keluaran penerus mempunyai aras arus

terus bersama perubahan arus ulang alik yang besar. Bentuk gelombang yang dikenali sebagai voltan arus terus denyut yang masih belum boleh digunakan sebagai bekalan arus terus yang memuaskan. Bagi mengeluarkan kandungan arus ulang-alik litar pelicin digunakan yang merupakan penapis laluan rendah yang membenarkan arus terus melaluinya dan mengurangkan riak "ripple". Frekuensi riak ini ditentukan oleh jenis penerus yang digunakan iaitu penerus separuh gelombang penuh akan mengeluarkan frekuensi riak yang sama manakala penerus gelombang penuh akan memberikan frekuensi riak dua kali ganda frekuensi masukan.

Walaupun riak ini dapat dikurangkan oleh litar pelicin iaitu terdiri daripada kapasitor dan perintang tetapi pada satu takat ia tidak dapat dikurangkan bagi memperolehi arus terus yang licin. Oleh itu penggunaan penerus notch "notch filter" digunakan bagi mengurangkan riak dan juga hanya membenarkan satu julat frekuensi sahaja melaluinya.

Tesis ini membincangkan tentang prinsip bagi kedua-dua litar, ciri yang harus dititikberatkan dalam menghasilkan litar tersebut dan juga keluaran yang harus diperolehi apabila mengaplikasikannya.

ABSTRACT

In electronic circuit, the separation between one frequency and another frequency is needed. It is done by filter and it is applied where low-level signal must be amplified, there may be present one or more of an assortment of unwanted noise signal and for example ripple from full wave rectifier. The notch filter only allowed the desired signals would exit from the filter.

The best known application of full-wave rectifying techniques is in DC power supply circuits, which provide DC power outputs from AC line input and consists of little more than a transformer that converts the AC value, and a rectifier-filter combination that convert this new AC voltage into smooth DC of the desired voltage value.

Full wave rectifier will permits two input but in the same direction. AC obviously had taken from main power supply and thorough the transformer. The input voltage to the rectifier is provided by secondary winding of transformer. The transformer reduces the AC voltage obtained and appearing across the transformer's secondary terminals has a peak magnitude on the order of the DC voltage level desired from the power supply. The transformer also provides DC isolation between the AC power line and the DC can pass across the coupled windings of transformer.

The output from rectifier produced the DC and the pulsating DC voltage is not pure DC, so capacitor and resistor is placed across the DC output terminals of the bridge rectifier. It is used to reduce the ripple that has been produced by full wave rectifier. The ripple is depend on the types rectifier that is for half wave rectifier it produce the ripple same as for input frequency and for full wave rectifier it give double ripple frequency from the input frequency.

Eventhough the ripple can be removed by placing the capacitor and resistor but at the certain limit it can't give the smooth DC. The application of notch filter takes place by producing the smooth DC and allowed a certain frequency passed.

In this thesis it is include the principle for circuit, the design procedure and the expected output as it applied.

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CHAPTER 1

PROJECT OVERVIEW

1.0 INTRODUCTION

"Frequency Cancellor Design" is used to remove the unwanted noise signal and allowed the desired signals would exit from the filter and it is the combination of full wave rectifier and notch filter. Why notch filter is needed? It is because in application where low-level signal must be amplified, there may be present one or more of an assortment of unwanted noise signal and for example ripple from full wave rectifier. The notch filter only allowed the desired signals would exit from the filter.

The notch filter is particularly useful for rejecting unwanted line frequencies such as 50, 60, 100, 120 or 400 Hz within sharply defined limits. Applications are in such diversified areas as communications, telemetry, control, analog computers or sensitive chemical measurements. The operational - amplifier make use in application of overload protection on the input and output, no latch-up when the common mode range is exceeded. The op-amp was applied to the solution of such mathematical functions as integrated, differentiation and summing by electronic means.

The tuned circuits are used primarily in communication electronics. Audio and video circuits make extensive use of tuned circuits. Notch filter

can be used to eliminate the low frequency noise that can be generated in many audio systems. The application is to split the audio signal from a stereo, television or other communications system so that the high frequency of the audio goes to a small high frequency and the low frequency goes to relatively large low frequency speaker. It can be used to eliminate the 30 Hz that can be produced by turntable. By tuning the notch filter to 30Hz, this noise will be blocked by the filter while the high audio frequencies are allowed to pass.

The best known application of full-wave rectifying techniques is in DC power supply circuits, which provide DC power outputs from AC line input and consists of little more than a transformer that converts the AC value, and a rectifier-filter combination that convert this new AC voltage into smooth DC of the desired voltage value.

Filters can be classified as passive and active filter, the main disadvantage of passive filter is there are lack power supply is required. On the other hand the active filter can use operational amplifier in order to isolate each section of the filter from the source and load impedance effects.

1.1 OBJECTIVE OF THE PROJECT

Frequency Cancellor Design is used to removed the unwanted frequency. Normally by using the capacitor in order to reduce the ripple from full wave rectifier is still not satisfied and the other alternative is by using the notch filter.

The objective of this project is to design and implement the frequency cancellor design, which employed the notch filter by using the operational amplifier and full wave rectifier. It is used to reduce the ripple that has been produced by full wave rectifier. Beside of using the capacitor as a filter to get a smooth DC in full wave rectifier but it is still not smooth as well as using the notch filter. By using the capacitor it is achieved by using the higher value of capacitor for example 10uF, 500uF and more and at a certain value the ripple can't get rid off and the smooth DC cannot be achieved. Its can be done by using the notch filter as an output of full wave rectifier in order to get a smooth DC as possible and rejected the unwanted frequency. The project also makes use of Protel's software for schematic and PCB design.

1.2 PROJECT OUTLINE

Chapter 1 consists of the introduction and the objective of the project. It describes briefly about frequency cancellor design, which made up of full wave rectifier and notch filter and also it's application especially in the communication system.

Chapter 2 discussed about the theory of full wave rectifier and the active filter, the example of calculation also included. Chapter 3 consists of hardware design procedure and Chapter 4 includes the result and discussions by calculation and hardware testing for both full wave rectifier and notch filter.

And lastly as a conclusion in Chapter 5 discussed whether or not the objective of the project is achieved and the experienced as project goes on. It also include the further works that can be done regarding to the application of the project.

CHAPTER 2

LITERATURE REVIEW

2.0 FILTER CIRCUIT CONCEPT

A filter is an electrical network, which is designed to modify an electrical signal applied to its input terminals. Other filters may be designed to pass a range of frequencies about a given selected frequency, rejecting frequencies outside the selected band and vice versa. The fundamental principles of electrical wave filters were outlined by Wagner in Germany and Campbell in the USA around the year 1915. There are many ideas and techniques related to the modern network theory and feedback analysis, for examples the Bode and Black on the stability of amplifiers. The choice of type of filter from the large range of filters must be influenced by several factors, some of which are: complexity, ease of tuning and whether or not power supplies may be required. [1]

Filters may be classified as a passive or active. By referring to figure 1.0 it can be seen that active filter realization are more advantageous at lower frequencies than in the case for passive types, although the reverses true at higher frequencies.

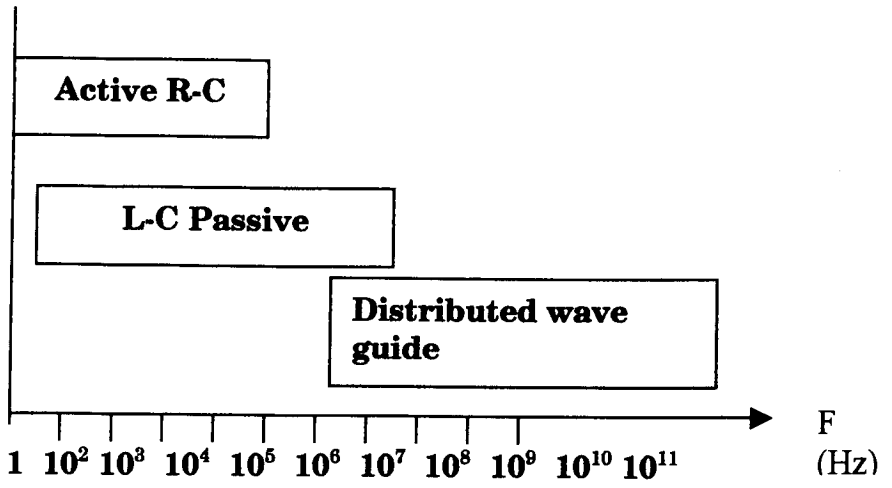

FIGURE 1.0 COMPARISON OF FREQUENCY RANGE OF FILTER [1]

2.1 ADVANTAGES OVER PASSIVE FILTER

Passive filters are the combinations of resistance and capacitance or inductance and capacitance and can be designed to cover a wide band of frequencies (typically 10 Hz to 500 Hz). The advantages over active circuits in that they do not required an external power supply and that they have low sensitivities to component variation. At lower frequencies the large coils having low *Q* factors. The coils usually require efficient magnetic cores and special winding technique to enable a reasonable level of quality, which increased the cost. [1]

Actives filter is the combination of resistors, capacitors and an active source, which is usually an operational amplifier. The main advantages over the passive types are that expansive and bulky coils are eliminated, circuit gain may be realized, and high input and low output impedance